

THE ZOOLOGIST

No. 214.—October, 1894.

CONTINENTAL OYSTER CULTURE.

By CAPT. C. C. LONGRIDGE, Assoc. Inst. C. E.

FOR much of the information in these articles I am indebted to Dr. Professor D. Carazzi, Director of the Museum at Spezia; to Mr. J. G. Haggard, Her Majesty's Consul at Trieste; and to Signor R. Allodi, one of the Directors of the Austrian Society for Fisheries and Sea Fishing. The subject is divided synthetically and analytically; in the first articles the various methods of culture are described, in the last certain practical conclusions are deduced. Illustrations of the systems are in the hands of the writer, from whom particulars can be obtained.

I.—ITALIAN OYSTER CULTURE.

A typical instance of the Italian system is found on the Oyster farms of the Mare Piccolo of Taranto. Behind the town and to the east, the sea forms a small bay, and is divided into two basins by the promontory of Penna. This tongue of land leaves an opening of about 500 yards between the basin nearer the town—the inner sea, and that more remote—the outer sea. Neither of these basins is more than two miles wide, and the two together are about five miles long. The north side of the Mare Piccolo receives a few streamlets of fresh water, and the inner sea covers two springs of fresh water, rising a few hundred yards from the shore. The bottom of the Mare Piccolo is a black, soft, odoriferous mud, which, near the town, is polluted with the sewage of 300,000 inhabitants. Fortunately natural conditions

ensure a steady flow of water between the Mare Piccolo and the Mare Grande, and somewhat cleanse this cesspool. Taken at $63\frac{1}{2}^{\circ}$ F., the average density of the water is 1023, rising to 1025 near the railway. The depth of the sea varies from 26 to 39 ft.

Here some thirty-two proprietors possess Oyster farms, varying in size from 2000 to 3000 square yards. The Tarantine Oyster farm (*sciaia*) is formed thus: into the bottom of the sea four or five rows of stout piles, either single stakes (*piombi*) or pairs (*fuerci*), are driven. The stakes are set about 15 ft. apart, and project 3 to 6 ft. above water level. The form of this stake-work or palisade is usually rectangular, 325 by 98 ft., giving a moderate-sized farm. At the ordinary half-tide mark the stakes are bound together with a thick grass rope (*libano*) extending round the whole palisade. Every pair of opposite stakes also is tied together; the parallel ropes so formed are called *ventie*, and these with the *libano* divide up the whole farm into a number of square spaces (*camere*), of which the sides are 15 ft. Lastly, across these spaces, from corner to corner, diagonal ropes (*crociere*) are stretched. The purpose of this network of horizontal ropes will be presently explained.

The method of collecting the young Oysters is a special feature of this system. In the natural course of events the brood, after issuing from the mother, swim freely in the sea for some two or three days. After this period they attach themselves to any solid substance in their way, and develop as Oysters. Failing to meet suitable materials, such as rocks, stones, wood, &c., they sink to the bottom, and, if material for attachment is there not forthcoming, they perish. Artificial collection therefore consists in providing the spat with substances to which they can cling; such substances are called collectors.

The typical Italian collector is a bundle or fascine of dry branches. Chestnut, oak, plane-tree, juniper, furze are used, but the lentisk (*Pistacia lentiscus*) is preferred. During the months of March and April, so as to be ready for the spatting season, the boughs are dried and beaten free of leaves. Then they are tied up in bundles with a piece of grass rope. About one yard of this rope is left free to be used for attaching the bundle to the mooring-rope or *steso*. The fascines are next dipped into a thick solution of lime mixed with a little hydraulic



cement. This not only preserves the wood, but facilitates the adhesion of the spat. After drying, the collectors are ready for use.

The operation of collecting begins with the spatting season, that is, towards the end of April, and lasts during May and June, sometimes longer. Some 2000 to 5000 fascines are used by each proprietor. A *steso* or mooring-rope is taken, and to this 110 to 130 collectors are tied, about 5 ft. apart. Then another *steso* is treated, and so on. Every seventh or eighth collector is weighted by a 16 to 20 lb. mooring-stone. All being now ready, the owner chooses the position for his collectors, and begins to lay them down. At Taranto the Mare Grande is selected, and the collectors are deposited there, some distance from the farms.

When the spatting season draws to a close, the collectors are withdrawn. This takes place generally in July, sometimes in August, and is effected by a boat and grapnel. If the Oysters are found to be few and small, the fascines are replaced. But at the end of August, or at latest half-way through September, the greater number of the collectors are in the farms. As soon as they arrive, they are cast off from the *steso* and made fast to the stake-ropes near the shore. This is a convenient position for the next operation, which is carried out in the following manner. Boys, generally the proprietor's sons, under the direction of an overseer, cut up the fascines on which are the young Oysters. The boughs are divided into sprigs (*zipoli*) about 8 in. long, which are put into baskets and carried back to the stakes. In the meantime a number of pieces of rope 12 to 24 ft. long are cut. One of these pieces is taken by a workman, a knot is tied at one end, and near this end the strands are untwisted. An opening is thus made, and into it one or two sprigs are set; the strands are then released, and the torsion of the rope holds the sprigs tight. Next the strands a little higher up are untwisted, more sprigs are inserted, and so on, until about 18 in. of the rope is left. With this free end the rope and its Oysters is tied on to one of the horizontal ropes (*ventie* or *crociera*) in the *sciaia*, and allowed to hang vertically downwards. Piece after piece of rope is treated thus until the sprigs are exhausted. The horizontal network of ropes attached to the stakes, as already explained, thus becomes laden with vine-like pendants of Oyster-bearing ropes, called *pergolari*. The length of these *pergolari* depends on the

depth of water. Allowing one yard for the dip of the horizontal rope at its centre under the weight of the Oysters, and another yard as the distance the end of the pendant should be from the bottom, the length of rope for 18 ft. of water would be about 12 ft.; for 30 ft. of water about 24 ft., and so on. The *pergolari* are usually set about one yard apart; if closer, the Oysters do not develop so rapidly.

As will be easily understood, many Oysters, during the above operation, become detached from the fascines. Loose Oysters, so detached, are laid side by side, base or joint upwards, in a flat open basket. Over them is scattered a layer of one-year-old Mussels; the basket with its mixed contents is then hung on to the palisade. Eight or nine days suffice for the Mussels to attach themselves to the Oysters and to one another. The baskets are then withdrawn, and handfuls of the united Oysters and Mussels are worked up between the strands of rope, and form mixed *pergolari*. These are first hung horizontally (*a radicola*) by tying the ends to the two opposite ropes of a *camera*. In this way the strands hold tighter, and the shells are less likely to drop. After a few days the Mussels adhere to the rope, and the *pergolari* can then be hung vertically.

As the Oysters grow, overcrowding is avoided by remaking the *pergolari*. This takes place in December. The sprigs with the larger Oysters are collected and remade into separate pendants; those with smaller shells are sorted out and reset; whilst a few Oysters (*a cunichiella*) are formed into a third set of pendants. A *cunichiella* is a name given to such Oysters as have grown opposite each other on the same sprig, and are therefore attached together only by a small portion of wood at the base of the shell. Such pairs are cut off and inserted between the rope strands, and are reckoned to produce the finest class of Oysters. Loose Oysters are treated with Mussels as before. The mixed *pergolari* require a weeding out of the Mussels to give the Oysters greater space for development.

At the beginning of the following summer some of the Oysters are so far grown as to be ready for sale. These are detached, and in numbers of 300 to 400 are placed in the *nassa*, a wicker basket, in which they can be quickly drawn from the water for sale.

By this system of culture a good part of the Oysters can be

sold at fourteen to eighteen months old, and nearly all the rest at eighteen to twenty-four months.

The market classification and prices are as follows:—1st quality, or *grossone*,—these are the Oysters *a cunichiella*, twenty-four months old; price £1 to £2 per 1000. 2nd quality, or *uso Bari*,—these are the best selected out of those eighteen to twenty-four months old; price £1 to £2 per 1000. 3rd quality, or *uso Napoli*,—the ordinary run of Oysters between eighteen to twenty-four months old. Their mean diameter is $2\frac{3}{8}$ to $2\frac{1}{2}$ in., and average weight 88 lbs. per 1000. Price 5s. 6d. to 10s. per 1000. The *uso Napoli* constitute two-thirds of the annual produce. 4th quality, or *sotto Napoli*,—the Oysters rejected from the above classes. Their mean diameter is $1\frac{3}{8}$ to 2 in. Price 4s. 2d. per 1000.

The above are wholesale prices at the farms, and do not include packing or delivery. The mean wholesale price of the bulk of the annual produce may therefore be taken as 7s. 6d. per 1000.

As regards the working costs of the Tarantine system, an estimate is given by Dr. Carazzi in '*Ostricoltura*' (Manueli Hoepli). This estimate is for a moderate-sized farm, say of 3000 square yards. The rent is fixed at £18 per annum. Two hundred and sixty stakes, costing 4s. 2d. to 8s. 4d. each, are reckoned at an average price of 6s. 3d., or in round numbers £80. Three rough flat-bottomed boats cost another £24. Stakes and boats together therefore cost £104. Calculating interest at three per cent., and total depreciation in ten years, the capital sunk in stakes and boats is represented by 18 guineas per annum. Probably 30 stakes a year will have to be replaced at a cost of another £10; the boats also will require overhauling—say a further £4 per annum. The total annual expenditure for stakes and boats therefore is about £28. Grass rope, 15,000 lbs., may cost another £32 per annum; and 2000 fascines as collectors at $2\frac{1}{2}$ d. each, another £20; whilst for baskets £2 may be allowed. For labour, six men are reckoned at 10s. per week, or $6 \times 10s. \times 52 = £156$ per annum; adding something for boys, the total labour may be estimated at £160 per annum.

The average yield of such a property is 750,000 Oysters per annum. These sold at 7s. 6d. per 1000 realize £281, so that the balance-sheet is:—

RECEIPTS.	EXPENDITURE.
To Sale of 750,000 Oysters at 7s. 6d. per 1000 . £281	By Rent £18 ,, Stakes and Boats . . . 28 ,, Rope 82 ,, Collectors 20 ,, Baskets 2 ,, Labour. 160 Balance (Profit). . . . 21
£281	£281

But how can an industry showing only £21 profit per annum flourish? In the first place the above figures do not include the sale of Mussels and fish caught on the estate; in the second, the farm is usually worked by the proprietor and his sons, the labour therefore is not entirely a cash disbursement; and in the third place, the property is generally inherited from father to son, and is gradually improved, so that the 13 guineas per annum for depreciation, &c., may be neglected. But methods of lessening the working costs are much needed to make the industry more lucrative. Rent also is too high; and Government do little to encourage the industry.

In Lake Fusaro is another example of the Italian or Tarantine method, slightly modified. The bottom of the lake is generally muddy, and in many places covered with *posidonia*.

A maximum depth of 20 ft. frequently shoals to less than 3 ft. The water is turbid and rich in organisms. The density at 63½° F. is 1022. One modification here introduced consists in forming some 260 small mounds of stones (*rocchi*) in several parts of the lake. On these are deposited a number of Oyster-mothers brought from Taranto. Round these beds is planted a circular shelter palisade, in the vicinity of which, when the spatting season approaches, wicker baskets are sunk. Every morning these baskets are examined, and as soon as spat is noticed, the fascines used as collectors are immersed. Previously testing for the presence of spat in this manner has a practical advantage, in so far as the collectors are kept free from deposit and slime, and the adhesion of the brood takes place more readily. For mooring the collectors, stakes about 15 yards apart are planted towards the centre of the lake, and united by a grass rope. To this rope the collectors are tied, and weighted so as to be immersed 1 to 3 yards, according as they are nearer to or further from the stake. Other fascines are laid on the bottom. The

collectors are left one to two months, when they are taken into the stake enclosure. Later on the fascines are cut up and made into *pergolari*. When the time comes for remaking these, the big Oysters are not remade in *pergolari* or pendant ropes as at Taranto, but are placed in closed wooden chests suspended in the enclosures; the small Oysters, however, are remade as before.

These illustrations may suffice to describe the distinctly Italian system of Oyster culture. In the immediate vicinity of Venice, however, Oyster rearing is carried on in rather a different way. Breeding is not attempted, but young Oysters cast up or dredged are laid down in shallows (*valli*), or portions of lagoon with a varying depth of 9 to 12 ft., intersected by small channels (*ghebi*). At low water the bed of the *valle* is dry, the channels alone remaining navigable by small boats. The water is always calm, with rapid currents in the channels at ebb and flow. Close by debouches a branch of the river Brenta supplying fresh water, and thus explaining the inaptitude of the locality for breeding purposes. The Oysters grown here, for the most part on shelly sand, are regular in form, clean and strong shelled, but their development is slow. At one year old the average diameter is $\frac{4}{5}$ to $1\frac{1}{2}$ in.; at two years of age only a few are saleable; the majority must be kept another year to reach market size. This system more resembles the French method.

II.—FRENCH, DUTCH AND AUSTRIAN OYSTER CULTURE.

Along the French littoral of the Atlantic, especially at Arcachon and Auray, Oysters are largely farmed. The basin of Arcachon, one and a half hours by train from Bordeaux, has a circumference of 50 miles. A tongue of sandy ground, wooded with pine, extends from north to south, where an inlet places the basin in communication with the Atlantic. Along the shore of this inland sea, 10,000 acres of beach are dry at low water, and afford sites for the farms (*parcs* or *claires*), which are divided and enclosed by embankments of fascines and earth, serving not only to mark the farm, but also to retain the water which at flood enters through self-closing sluices. The area of an average-sized farm is 150 by 325 ft., and it is usually intersected by 6 ft. wide canals.

For collecting spat, curved tiles are used. These are piled

up in groups, fastened together by a wooden frame or iron wire, and then dipped in lime and cement. From the 30th May to 16th June is generally the best time for laying the collectors, which, every three months, are taken to pieces, cleansed and relaid.

After eight to nine months the tiles are taken ashore, and the young Oysters removed by a special knife. This process is called *détroquage*. When it is accomplished, the Oysters are washed and placed in safes called ambulances. These are made of rough rectangular tarred wood frames, provided with short 18-inch legs, and a moveable top. The ends, sides, tops, and bottoms are mostly of galvanized netting; thus the flow of water is not impeded, whilst the Oysters are secured from their enemies. Every day at low water the safes, which are then dry for several hours, are examined, and the contents cleaned and re-arranged if necessary. In five to six months the Oysters usually measure $1\frac{1}{2}$ to 2 in. diameter; and are then removed from the ambulances and bedded in the parc.

At Cape Breton, however, the Oysters are not bedded, but reared entirely in safes. Their growth is thereby accelerated, and in seven months their diameter reaches $3\frac{1}{2}$ to $3\frac{3}{4}$ in.

Oyster rearing at Thau, near Cette, is chiefly noteworthy for the method by which the ambulances are secured. The Oyster farms here are in reality rafts floated on empty petroleum barrels, and moored in the canal leading from Thau to the sea. The bottom of the canal is muddy sand, the current strong, and the position unsuited for bedding; safes therefore are used. These are tarred wooden trays with wire netting or wooden lattice bottoms. On these trays rows of $1\frac{1}{2}$ to 2 in. Oysters brought from Arcachon are laid, one Oyster leaning against its neighbour, joints downwards, the bigger Oysters in the centre, the smaller at the sides. About twelve to fifteen trays are then placed on the top of one another, and secured to an empty barrel by two chains passing round the lot. The apparatus is then immersed and moored to a floating beam. In this way the Oysters are left to grow to maturity, but every three months the trays are raised and cleaned by dashing water over them. In eleven months the Oysters reach $2\frac{1}{2}$ to $3\frac{1}{2}$ in. diameter, and are ready for market.

It may passingly be noted that on the French coast of the Atlantic, suitable localities for Oyster rearing are very numerous, but those for breeding purposes are practically confined to

Arcachon and Auray, whence numbers of young Oysters for rearing are obtained.

DUTCH OYSTER CULTURE is very similar to the French procedure at Arcachon. The farms vary in size and complexity according to the amount of capital invested, but they conform to a general type of the following character. Each, says Dr. Fowler, whose description I here follow, consists of two sections: the one, an area of 12 to 150 acres in the bed of the Schelde, covered at half-tide; the other, on dry land, comprising the necessary buildings and ponds, or *putten*. The river section is generally divided into one area for the collectors, and another often some distance off, where the half-ware, or young Oysters, are placed to grow to a marketable size. The river water is conducted through a canal and sluices into the ponds, which can also be put into direct communication with one another by other sluices. The natural rise and fall of the tide effects the changing of the water. The method of procedure is this:—The collectors, common roof tiles, coated first with hard, afterwards with soft lime, and thoroughly dried, are set about June in the bed of the Schelde at low water, at right angles or broadside to the current, and sloped so as to make little eddies, into which the swimming spat may be swept; they lie there, except for being occasionally swilled in water to wash off the mud, till September or October, by which time, if the season be good, numbers of tiny Oysters will be found adhering. The tiles are then brought ashore and arranged in a pond in about 3 to 4 ft. of water, which, as explained, is constantly changing. Here they remain till February, when the young Oysters are detached, and placed in the hospitals or ambulances. These, like the French, are generally made of tarred wood, and are shallow trays about 6 in. deep, standing on legs about 6 in. off the ground; they rest on the bottoms of ponds, singly or in two tiers, according to the depth of water, 3 to 5 ft.; in some cases they are allowed to float. Here the young Oysters remain for about two months to recover from any damage they may have incurred in detachment; at the end of this time they are bedded out on the private beds in the Schelde. The grounds on which they are laid are occasionally cleaned by dredging without a net. The Oysters are considered marketable in the third and fourth year, and are then dredged up and laid down in the store

pond ready for use. The store pond is generally floored with tarred planks, an expensive material, but found to be better than either the natural ground, which becomes foul, or than brick, which is too cold. The water is kept about 4 ft. in depth.

AUSTRIAN OYSTER CULTURE is interesting as presenting a combination and evolution of the preceding systems. The Austrian Society for Fisheries and Sea Fishing appears to have begun Oyster culture more or less on French or Dutch lines, but to be now adopting mostly the Italian system. In 1889 the society established a farm at Zaule, near Trieste. At some 120 yards from the shore, an area of 100 square yards was enclosed by stake work, 20 yards long by 5 yards wide, with a depth of 4 yards at mean tide. Above high-water mark the stakes were united by cross bars with supporting piles at intervals of $2\frac{1}{2}$ yards. These stakes were also $2\frac{1}{2}$ yards out of water at low tide, and were driven 4 to 5 yards into the thick muddy bottom. From the cross bars were hung frames of galvanized wire netting, 2 by 3 yards, intertwined with branches for the double purpose of collecting spat, and preventing it from being carried out of the enclosed space by any seaward current. Within this space were placed collectors of every kind, and between them Oyster-mothers were placed in cages of wide-meshed wire netting, so fixed that they hung $1\frac{1}{2}$ yards under water. During the months of January and March the first young Oysters were detached from the collectors to the number of 40,000, and, placed in breeding safes, suspended from the palisade in about 2 yards of water. After this trial the society enlarged the enclosure to 400 square yards, half of which was to serve as a breeding, and half as a rearing, ground. But in the spring of 1892 the erection of a petroleum factory so polluted the water that the undertaking had to be abandoned.

The society then initiated experiments at Palazza, where shallows of 30,000 square yards, with rather less than one yard depth at low water, were used. The bottom is hard shelly sand. In 1891, 5000 lime-coated tiles were laid in heaps as collectors. In 1892, 100,000 young Oysters were detached, and placed to grow in galvanized wire safes. These were suspended from ropes attached to stakes, and hung $1\frac{1}{2}$ yards under water at low tide. Both stakes and ropes were in the Moreri channel, which is about

50 yards wide, and 5 to 8 yards deep, with an earthy mud bottom; the water is rich in organisms. In April, 1893, recourse was had to the Italian fascine collectors, and the Tarantine system of rearing. The growth of the Oysters so reared was very rapid. After seven months' treatment they increased to a diameter of $2\frac{2}{5}$ to $2\frac{4}{5}$ in., or at the rate of $\frac{2}{5}$ in. per month.

At Bandon, near Fasana, Oyster culture under Signor A. Gareis has for some time been in use. In a depth of 4 yards at average half-tide, a palisade of fifteen rows of stakes has been erected, the stakes being set 5 yards apart, and united by an iron wire. From this wire, collectors laden with young Oysters from Pola are suspended one yard apart. The first collectors were metal rectangular frames 4 yards long, with thirty-six to forty iron vertical blades about 32 in. long; but these were abandoned in favour of wooden frames, from which hung juniper branches. These wooden collectors, which proved cheaper and more durable than iron, are dipped in pitch and sand before use. The young Oysters remain on them until fully reared.

To give the final fattening, Signor Gareis has constructed a small basin, 30 by 20 yards, with gravel and pebble bottom. The basin is divided into compartments, 1 by 10 yards, and is fitted with sluices opening with the flood and closing with the ebb. By this means the Oysters even at low tide are still covered with 12 in. of water, whilst at high tide there is more than one yard. The sea-water near the basin is mixed with fresh, and the fattening of the Oysters is very rapid.

Near Jagnina, artificial Oyster-rearing is conducted by Signor S. Bielovucic. An arm of the sea, surrounded by hills, forms a lagoon of some 200,000 square yards. The bottom is mostly sand mixed with clay. The depth of water varies from 5 yards at the extremities to $3\frac{1}{2}$ yards at the middle, whence it slopes off towards the west shore, leaving there a slip of about 10 yards wide dry at low water. The collectors used were, at first, ninety heaps of lime-coated curved tiles, 20 in. by 6 in., sixty of these being superimposed in layers to form one heap, or collector. The tiles were strung together through a hole at each end, and the whole pile rested on two blocks of wood. These collectors were immersed in depths varying from $2\frac{1}{2}$ to $3\frac{1}{2}$ yards. Besides these, eighty bundles of furze, as collectors, hung from a chain extended from stakes in the centre of the lagoon, in a depth of 8 yards, and

beneath them, on the bottom, Oyster-mothers were placed. When $1\frac{1}{2}$ to 2 in. in diameter, the Oysters are taken from the tiles and bedded along the western shore. Those attached to the furze collectors are treated on the Tarantine method, the necessary palisade being erected in a depth of $3\frac{1}{2}$ yards at half-tide.

The French and Italian methods therefore are here worked together. The Oysters grown on the former method are regular in form, but slow in growth; those reared on the latter system are less regular in shape, but rapid in development.

The Oyster culture at Lussinpiccolo is noteworthy for the method of suspending the collectors. The sea here, even close to the shore, is deep, and the fascines which the proprietor, Signor Smircich, intends to adopt next year are to be suspended from a raft. Hitherto slabs coated with tar have been so hung, and the Oysters, when detached, have been reared in safes; but it is likely that the Italian system of *pergolari* will be adopted. Probably from a deficiency of fresh water, fattening cannot be effected.

At Ponte, on the Island of Veglia, under the auspices of the Prior of the Monastery and the Parish Priest, young Oysters brought from Grado have been reared in safes supplied by the Fishery Society. The trial has been so successful that an Oyster farm, similar to that at Lussinpiccolo, is established, and here also it is probable that the Italian or Tarantine system will be followed.

From this brief description of the chief continental methods of Oyster culture, I shall now deduce certain practical conclusions.

III.—PRACTICAL CONCLUSIONS.

These refer to the selection of breeding, and of rearing and fattening grounds, as also to the manipulation of collectors and other details of the several systems described.

A topographical study of the various Oyster farms show that, roughly speaking, breeding and rearing grounds seldom, breeding and fattening grounds never, can be identical. In fact it may be said that the more favourable are the conditions for breeding, the less favourable they are for rearing and fattening, and *vice versâ*. Why this should be so is not so easy to tell. The question of Oyster reproduction is indeed exceedingly obscure. Oyster-mothers, or spawners, have been placed on rearing-grounds, they

have been observed heavy with spat, the brood has been emitted, collectors laid around, and yet scarcely a trace of deposit has been found. Whether, under the conditions favourable to artificial rearing, the spat is not properly fertilized, or the brood are born too feeble to survive, or are deficient in the secretion by which they adhere, or are otherwise wanting, is hard to say; but the fact remains that the mixture of salt and fresh water, that is most favourable to rapid growth and development, is apparently fatal to successful reproduction.

This fact narrows the choice of a situation for a breeding-ground, but the selection is further restricted by a condition that every locality suitable for successful reproduction must satisfy, *i. e.*, it should be near a rearing-ground. When first they adhere to the collectors, the young Oysters are very small and delicate. Now for several practical reasons the collectors should rarely be left on the spatting-ground for more than two, three, or at most four months. Hence the young Oysters have to be moved at a critical age, and if the rearing-ground be not near at hand, the mortality is likely to be heavy. It is only when the Oysters have attained a diameter of $1\frac{1}{8}$ to $1\frac{3}{8}$ in. that they can be safely carried to a distance. A salinity of sea-water, and contiguity to a rearing-ground therefore are two conditions of aptitude for breeding purposes; but in selecting a breeding-ground there are also some physical signs by which suitability may be further recognised. The most unmistakeable sign of all is, the existence of an Oyster-bed. But even where this is wanting, the presence of Oysters, especially if they are numerous, is a sure indication of aptitude. Yet the absence of Oysters is not a positive proof of inaptitude for breeding purposes, for in many very suitable places this absence has been traced to the deficiency of solid bodies on which the brood could collect. Not unfrequently where Oysters were scarce, the construction of a breakwater, or stonework, has sufficed to make them numerous. Spezia and Venice may be cited as instances. Another, and to some extent satisfactory indication of fitness, or the reverse, is the nature of the bottom. A clear, clean, and homogeneous mud, like clay, appears to be very suitable, and it is a favourable indication if the calcareous tubes of *Serpula (vermi anellidi tubicoli)* are found adhering to any submerged body. Grounds covered with algæ and *Zostera* (sea-wrack) are to be avoided, as also those of quartz sand, especially

if near to a steep rocky coast exposed to a heavy sea. Shifting sands and soft mud also are objectionable. These indications are useful, but not absolute, especially as regards mud. This *per se* would not be injurious to reproduction, if it had not the disadvantage of being too soft and slimy.

When the presence of these marks indicate a likely ground, a test may be made by laying Oyster-mothers, and, at the spatting season, setting collectors. For test-collecting only, the kind of collectors used is immaterial, but when it is a question of collecting for rearing purposes, the collectors should be adapted to the system in view. Thus, if the Italian method of rearing is to be used, wood fascines are preferable; for they can be easily worked up into *pergolari*. But if the French or Dutch plan of bedding is to be employed, then tiles are better, for the Oysters can be more easily detached. Where both methods are to be adopted, both sorts of collectors should be used. Collectors of small shells and Oyster culch, as Signor Allodi points out, present serious difficulties in detaching the young Oysters. As regards the position for setting collectors, it may in general be said that they should not be laid in shallow water, or too near the shore. It is difficult to give figures, but at Spezia the collectors are deposited a full $\frac{2}{3}$ mile from the shore, and at a depth of $12\frac{1}{2}$ yards. At Taranto the closest they are to the shore is $\frac{5}{8}$ mile, but the usual distance is more, and even as much as $12\frac{1}{2}$ miles; the depth is $12\frac{1}{2}$ yards. Of course, in setting collectors, it is advisable to consider the direction in which the current is likely to carry the spat, and to set them not end on, but broadside to the direction of the current.

As to the number of collectors to be employed, the more the better. In any case not fewer than 400 to 500 should be used at any one point. Thus if a trial is to be made at two points there should be a thousand collectors, and so on.

The time for setting the collectors naturally coincides with that of the spatting season. The collectors therefore should all be in readiness at the beginning of the month in which the spat is expected. If it is considered desirable to keep them dry and clean till the spat actually appears, and this is an advantage, then test-collectors should be laid. These should be frequently and carefully observed, for the shedding of the spat takes place almost simultaneously among all the spawners, and unless the collectors

are immediately used, much may be lost. After immersion, the collectors should be examined fortnightly, and if no deposition of spat has taken place, they can with advantage be taken ashore, quickly dried, and as quickly replaced. Tiles should invariably be dipped in lime and cement; this facilitates both the adhesion and the removal of the young Oysters. Fascines also should be dipped to give a better surface for adhesion.

How long, it may be asked, should the collectors be left after the spat is deposited? The less time the young Oysters remain on the collectors *in situ*, the less will be the loss inflicted by their enemies. On the other hand, the brood are at first very delicate, and exposure to the air, or the sudden change from the deep water of the breeding-ground to that of the farm, may suffice to kill them. Consequently much experience and prudence is necessary. At Spezia, the time allowed is usually forty, to a maximum of sixty days; at Arcachon, eight to nine months; but in this latter case the collectors are taken up and cleaned every three months.

Another practical consideration in the selection of breeding-grounds relates to the necessary physical conditions of the sea. Both temperature and saltness are important factors in the question of reproduction. Within ordinary limits, the higher the temperature, the greater the quantity of spat emitted. Cold may delay the spatting season, heat will accelerate it. As to the best degree of saltness, it may be said approximately that at a temperature of 68° F. to 86° F. the density of the water should not vary much from 1025.

Turning now to the question of Oyster-rearing, it appears that, in general, artificial rearing cannot be conducted in the absence of three conditions. First, protection from heavy sea; secondly, moderately shoal water; thirdly, the presence of a certain amount of fresh water from either spring, river or canal. Wherever these conditions are found, artificial Oyster-rearing is possible. The necessity of the first two conditions is obvious: it is not a question of laying down and withdrawing the Oysters ready for market, but of continual attention and work which is not possible except in calm water of moderate depth. The importance of fresh water for rearing purposes is both negative and positive—that is to say, it is on the one hand necessary to counteract evaporation, which in shoal water, especially in warm climates, is

likely to increase the salinity to an undesirable degree, and on the other hand, its presence enables the fattening ground to be identical with or contiguous to the rearing-ground, thereby effecting economy of labour. For fattening purposes fresh water is indispensable. The density of the most suitable mixture appears to be about 1014. Positions then, where there are surface currents or springs of fresh water, or which are near the mouth of a river or canal, are, if other requisites are present, the most eligible sites for rearing and fattening grounds. There should be daily tidal changes of water; and the stronger the current the better for the Oysters, as they thereby receive more abundant nutriment. The beneficial effect of strong currents is very noticeable at Thau. The water need not be limpid or clear. Turbidity is not injurious, provided the Oysters are not allowed to become choked with the mud deposited. Too much organic impurity is to be avoided. As the upper layers of water are fresher than those beneath, safes and baskets used for fattening purposes should be suspended near the surface. For the same reason, the Oysters near the top of the rope pendants in the Italian system fatten quicker than those lower down, but equality can be restored by occasionally inverting the ropes.

The lowering of the density from the 1025 of the breeding-ground to 1014 at the fattening site, explains why the latter is not suitable for breeding purposes, and why it is useless to set collectors in the immediate vicinity.

The fattening power of fresh water, though known to antiquity, is perhaps even to-day imperfectly understood. The result is certainly not due to the great nutriment contained in the fresh water, for in many cases it is freer from organisms than the sea water. In his 'Ostricoltura,' Professor Carazzi attributes the effect to the influence of fresh water in increasing the action of the liver, and favouring metabolism or the assimilation of food. This explanation derives support from the Oyster malady, called by De Montaugé "hepatitis," or inflammation of the liver, met with in the case of over-fed geese and birds. This affection is found only in Oysters put to fatten in too fresh water, and can be cured by returning the patients for a time to the sea. Whatever may be the true explanation of its influence, fresh water is undoubtedly desirable in a rearing and essential to a fattening ground.

But when it is present, and the site is otherwise eligible, there is still the question of the bottom. The system of culture must either be adapted to this, or a site must be found in which the nature of the bottom is adapted to the system. This is the general rule, but in cases where the Oysters are to be reared in floating ambulances, as at Thau, the nature of the ground is immaterial.

Except where the bottom is too hard for stake-driving, the Italian Tarantine method can be used anywhere. But the best site is where the bottom is of good holding material; and where the water is not less than 4 yards nor more than 12 yards deep—a less depth exposes the Oysters to sudden changes of temperature, and a greater depth makes stake-driving difficult and costly. The palisade may in general be rectangular, long and narrow, with the head or short side facing the prevailing wind or current.

For the French and Dutch systems of bedding, clean firm bottoms, such as coarse sand, gravel, hard clay, are required, and the best arrangement is one that permits the operator at will to draw off the water at low tide, so as to sort and arrange the Oysters at ease, and give them daily exposure to the air. This periodical exposure is an important commercial item, as it is found that Oysters so habituated live for a longer time out of water.

The Austrian is not a hard and fast system, but inclining mostly to the Italian practice, utilizes also French methods according to the nature of the ground.

In comparing the relative advantages of the several systems, it appears that Oysters laid to mature on the bottom, as in the French and Dutch methods, are more exposed to the attacks of worms, crustacea, and molluscs, &c., and, unless daily exposed to the air, they do not acquire the property of remaining many days closed when taken out of water; lastly, they develop slowly, and do not reach saleable size till after the second or third year, and are not sold as Oysters of first quality till the fourth year. On the other hand, the system is perhaps cheaper, and the Oysters are more regular in shape and stronger in shell. Where Oysters are grown entirely in ambulances, the system shares the advantages of the Italian method, in which the Oysters are suspended and

better protected from their enemies, develop rapidly, and become saleable in about half the time required by the French or Dutch bedding method. Observations taken at Spezia show that out of one hundred Oysters reared on the Tarantine plan, at fifteen months of age one-third were saleable as second quality Oysters, with a mean diameter of $3\frac{1}{2}$ to $3\frac{3}{4}$ in.; one-third as third quality, with a mean diameter of $2\frac{3}{4}$ to $3\frac{1}{4}$ in.; and one-third required further cultivation. At eighteen to twenty-four months of age one-half the Oysters were of first quality, that is, more than $3\frac{1}{2}$ in. diameter; and of the other half, part were of second quality, and part of third quality—all being saleable.

It would therefore seem that where a keen demand and high prices exist, any method of suspending Oysters during growth is likely to be most successful.

It may not be amiss to add a few words as to the stakes that form so important an item in the Italian Tarantine method. The experience of Dr. Carazzi tends to show that *Pinus pinaster*, also called *Pinus maritima*, or cluster pine, is the most durable material. That grown on dry siliceous soil exposed to the sun is preferable to that grown on damp clayey ground, sheltered from sunlight; for the bark of the former is found to adhere more firmly to the wood, and to resist longer the attack of the *Teredo*, or shipworm. This adhesion is also favoured by planting the stakes as soon as possible after they are cut. As a further protection against the worm, a certain number of the stakes should be withdrawn every year, and taken ashore to dry until any worms are killed, when they can be replaced. The life of a stake varies from three to eight or ten years.

For protection from the *Teredo*, ambulances are usually dipped in gas tar thinned with petroleum. This can be conveniently done by building a brick bath heated by a small furnace.

THE OTTER, *LUTRA VULGARIS*.

BY THE EDITOR.

(Continued from Zool. 1894, p. 47.)

IN the last instalment of this article (pp. 41-47) we left off with a graphic description of the actions of the Otter in its natural haunts, as observed in Scotland by the Brothers Stuart, and printed in their delightful 'Lays of the Deer Forest.' We have read nothing better, or more true to nature. It is evident, from their account, that the Otter, when undisturbed, enjoys a frolic in the water with its kind, just as other animals will gambol upon dry land. We have been eye-witness to this in the case of Foxes, Badgers, and Squirrels, but it has never been our good fortune to see what has been described and vouched for by several American writers in the case of the Otter, namely, its enjoyment in making and using a "slide" upon the snow-covered slope of a hill-side.

Sir John Richardson, one of the earliest writers to describe with precision the habits of the North American Otter (*Lutra canadensis*), has remarked that when its usual haunts are frozen over, it will travel overland to a great distance through the snow, and if then seen and pursued, it will throw itself forward on its belly, and slide through the snow for several yards, leaving a deep furrow behind it. This movement is repeated with such rapidity that even a swift runner on snow-shoes has much trouble in overtaking it. But this "sliding" is not only resorted to in the endeavour to avoid pursuit, and is something more than an easy way of slipping down a wet sloping bank to the water. It seems to be a favourite mode of diversion. J. D. Godman, in his 'American Natural History' (Philadelphia, 1826), remarks:—

"Their favourite sport is 'sliding,' and for this purpose in winter the highest ridge of snow is selected, to the top of which the Otters scramble, where, lying on the belly, with the fore-feet bent backwards, they give themselves an impulse with their hind legs, and swiftly glide head-foremost down the declivity, sometimes for the distance of twenty yards. This sport they continue apparently with the keenest enjoyment, until fatigue or hunger induces them to desist."

Audubon has described this remarkable trait in the Otter from personal observation. He says:—

"The Otters ascend the bank at a place suitable for their diversion, and sometimes where it is very steep, so that they are obliged to make quite an effort to gain the top; they slide down in rapid succession where there are many at a sliding-place. On one occasion we were resting on the bank of Canoe Creek, a small stream near Henderson which empties into the Ohio, when a pair of Otters made their appearance, and, not observing our proximity, began to enjoy their sliding pastime. They glided down the soap-like muddy surface of the slide with the rapidity of an arrow from a bow, and we counted each one making twenty-two slides before we disturbed their sportive occupation.

"This habit, he adds, of sliding down from elevated places to the borders of streams is not confined to cold countries, or to slides on the snow and ice; but is pursued also in the Southern States, where the ground is seldom covered with snow, or the waters frozen over."

These observations have been confirmed by subsequent writers, and within the last few years. Thus a correspondent of 'Forest and Stream,' writing from the Grand Rapids, Michigan, in March, 1889, remarked:—

"The 'Otter-slide' is made and used for the same reason that boys make a toboggan-slide, a place where they can play, and have fun. The Otters will play for a long time, sliding down, and scrambling back with as much apparent enjoyment as dogs having a frolic, or boys on a toboggan, and with no other motive. These facts were gathered from an old hunter and trapper, who was one of a surveying party with the writer in Michigan."

Again, in 'Temple Bar' for December, 1891, an "Old Trapper" writes:—

"Otter-slides are as smooth and slippery as glass, caused by the Otters sliding on them in play in the following manner:—Several of these amusing creatures combine to select a suitable spot. Then each in succession, lying flat on his belly, from the top of the bank slides down over the snow and plunges into the water. The others follow, while he crawls up the bank at some distance, and, running round to the sliding-place, takes his turn again to perform the same evolution as before. The wet running from their bodies freezes on the surface of the slide, and so the snow becomes a smooth gutter of ice."

Thus, extraordinary as it may seem, there appears no reason to doubt what has been vouched for as an observed fact by those who have described it.

Few animals vary more in size than the Otter, judging by the measurements and weights which have been recorded from time

to time by different observers; but allowance should be made for age, and possibly also for sex, although there is no marked difference in size between the male and female (the latter perhaps being somewhat smaller), and both continue to grow for some years after reaching puberty.

The measurements given by Bell in his 'British Quadrupeds' must have been taken from comparatively young animals. A good Otter will measure about four feet in length, and weigh from 20 to 25 lbs., the female a few pounds less. We can scarcely credit the statement of Pennant that (a century ago) one was found in the River Lea, between Hertford and Ware, the weight of which was 40 lbs. The weight in this case, probably, was only estimated.

In September, 1888, we were Otter-hunting with Mr. Collier in Somersetshire, and one day, after a run of some eight miles, killed a good Otter, weighing 16 lbs. On that occasion Mr. Collier informed us that during the previous week he had killed three Otters, whose united weight amounted to 64 lbs. In April, 1892, we were out with Mr. Courteney Tracy's pack on the Wiltshire Avon, and saw two Otters killed. The owner, in reply to our enquiries, then informed us that it would be an unusually heavy Otter that would weigh 25 lbs.

Our old friend Mr. F. H. Salvin, of Whitmoor House, Guildford, saw one killed in the Lune, near Lancaster, some years ago, by Mr. Lomax's Otter-hounds, of the exceptional weight of 25 lbs.; and Mr. Lomax then told him that the largest he ever saw weighed 30 lbs. It was found in a hollow willow in Warwickshire, and from the worn condition of its teeth was considered to be very old.

Mr. F. V. Starkey, of Wrenbury Hall, Cheshire, reported that in February, 1886, an unusually large Otter was killed in the brook which runs through his village. The length was stated to be 48½ in., and the weight 30 lbs.

The late Hon. G. R. Hill was of opinion that in Shropshire, where he resided, and where, as is well known, he hunted a pack of Otter-hounds, the average weight of a full-grown dog Otter is from 20 to 25 lbs., and of a bitch Otter from 15 to 18 lbs. The largest he ever killed, as reported in 'The Field' of June 20th, 1867, was an old dog Otter weighing 31 lbs. This is one of the heaviest British-killed specimens of which we have been able to

find any record, though it has been equalled by another which was killed by the Carlisle Otter-hounds. We learn from Mr. H. A. Macpherson, on the authority of the huntsman of that pack (T. Parker), that in Cumberland, bitch Otters vary in weight from 14 to 17 lbs., that he once weighed one of 20 lbs., and that the largest he ever saw weighed 21 lbs. "Dog Otters," he says, "when in condition, weigh from 22 to 26 lbs. Otters of 27 lbs. have been killed on both the Esk and the Lyne in recent years, but they were very big fellows. The heaviest and longest Otter that has been killed by the Carlisle Hounds was drowned in the Eden opposite the Ambrose Holme. This grand dog Otter scaled 31 lbs., and is preserved in the possession of Mr. Wilson, of Carlisle."* It has nevertheless been eclipsed by one that was killed more than thirty years ago by the Bishop Auckland pack, hunted by the late Mr. John Gallon, and which is stated to have weighed no less than 32 lbs.; but, in the words of the recorder, "this Saul among the people must be regarded as a very extraordinary specimen, and far beyond the usual size."†

A large Otter, much above the usual weight, was killed, according to Mr. Macpherson (*op. cit.*), in a singular manner in October, 1891. It was run over by an express train while crossing the railway line at Little Salkeld Station, M. R., and was found to weigh 26 lbs. Mr. Southwell informs us that a similar fate befel an Otter in Norfolk in December, 1893, when one thus run over was forwarded to Mr. Gunn, of Norwich, to be stuffed. He has noted also ‡ that one was taken in a bow-net at Ormesby, which weighed 27 lbs.

A male killed at Ranworth, in January, 1871, after three weeks' intense frost, although in a very emaciated condition and quite empty, weighed 30 lbs., its length being $50\frac{1}{2}$ in. A male killed in March, 1866, weighed 30 lbs.; and an old male, killed at Bowthorpe, weighed 37 lbs., being 48 in. in length. These, however, are quite ordinary beasts compared with one, also a male, taken by the Carmarthen Otter-hounds at the Cowen, and which an old sportsman says he saw killed and weighed. The

* 'The Fauna of Lakeland,' 1892, p. 37.

† 'The Field,' May 17th, 1862; and Meynell and Perkins, 'Catalogue of the Mammalia of Northumberland and Durham,' in Trans. Tyneside Nat. Field Club, vol. vi. (1864), p. 132.

‡ Trans. Norf. Nat. Soc. 1872-73, pp. 82, 89.

weight was 50 lbs., and the length, from nose to tip of tail, 66 in.* If this weight was actually ascertained and not merely estimated, we may well accept Pennant's statement as to the Lea Otter, which is said to have weighed 40 lbs. The weight of an Otter relative to its length must depend very much on its condition.

Otters, as a rule, are not liable to much variation in the colour of their fur, which is very thick, close, and shining. This is generally of a rich dark umber-brown, darkest on the back (looking almost black when wet), lighter on the sides, and palest underneath; in this respect resembling our common Water Vole. Nevertheless, white, cream-coloured, and even spotted varieties have been met with and recorded at rare intervals.

In Mr. Henry Evans's collection at Small Isles there is a pure white Otter, which was killed at Jura, and another is preserved at Kildalton House, Islay.† In the Belfast Museum also there is a white Otter, which was killed in Islay in April, 1850.‡

More than thirty years ago ('Field,' May 17th, 1862) two cream-coloured Otters, killed in the River Aln, were in the possession of Mr. Grey, of East Bolton; and about the same time there was preserved, at Newcastle-on-Tyne, a stuffed specimen, which was "spotted all over the body with white ticks, precisely similar to some pointer-dogs."

In 'The Zoologist' for 1869 (p. 1926), Mr. T. E. Gunn reported the capture near Yarmouth, in March of that year, of an old female Otter and two young ones about a fortnight old. The coats of the latter presented two distinct shades of colour, one being of a very pale brown, and the other very dark, nearly as dark as the adult; the mother was slightly piebald, having a few small patches of white on the crown of the head and neck.

In the 'Fishing Gazette' of June 24th, 1893, Mr. S. J. Hurley, of Killaloe, reported that a perfectly white Otter had been recently seen in the Shannon, and that some years previously he had seen one in the same locality with a white circle round its neck. A

* 'Land and Water,' vol. ii. p. 51.

† Harvie Brown and Buckley, 'Fauna of Argyll,' 1892, p. 17.

‡ When visiting Paris, in 1889, on the occasion of the last Exhibition there, we saw in the Museum of the Jardin des Plantes a white Otter which had been sent from China, and we had previously noted another, which was exhibited in 1887 in the Loan Collection of Hunting Trophies in the American Exhibition in London.

friend of the late Edward Alston once saw an Otter "with an irregular white collar round its neck, seemingly formed of a collection of spots."

A specimen in the Museum of the Jardin des Plantes, Paris, which has "the whole of the upper part of the fur irregularly spotted with pure white," has been noticed by Bell,* who remarks:—"It is by no means rare to see an Otter having a few white spots, though they are rarely as much marked as the one above mentioned." He adds:—"It appears to be a variety analogous to that which often occurs in birds having a few white feathers, which at the moulting period are often lost, and replaced by others of ordinary colour. This variety should not be confounded with albinism, which is retained for life."

We have heard of a black Otter, but have never seen one. A correspondent of the 'Fishing Gazette' reported (Oct. 3rd, 1891) that a fine specimen of the black Otter had been caught at Burnhervie, Aberdeenshire. It is possible that the reporter may have been deceived by the appearance of the animal when just taken out of the water, for the fur of a dead Otter when wet and lying close to the body looks much blacker than when the living animal has shaken off the moisture from its coat. And here we may remark how easy it is to be deceived by the appearance of an Otter which has been stuffed for many years. From long exposure to the light the fur becomes gradually paler, and in extreme cases almost bleached, so that we can well imagine such specimens may give rise to reports of cream-coloured Otters, and even of so-called white ones.

Passing now from the subject of "Variation," we come to the more vexed question of "Gestation," and upon this many pages might be written. But it must suffice if we summarise the observations of some of our friends who have paid special attention to the subject, and note briefly the results at which they have arrived.

No one, probably, has paid more attention to the subject of reproduction in the Otter than Mr. A. H. Cocks, of Marlow, who got a pair to breed in confinement, and Mr. Southwell, of Norwich, who, living in a county wherein these animals are more than usually common, has enjoyed good opportunities in the

* 'British Quadrupeds,' 2nd ed., 1874, p. 178.

district of the "broads" for learning much about their habits. In the 'Transactions of the Norfolk Naturalists' Society' for 1872-73, will be found an article (pp. 79-90), in which the last-named observer has given some most useful statistics relative to the number of young at birth, date when found, and probable age, with a view to fix the date of birth. Mr. A. H. Cocks, in 'The Zoologist' for 1877 (p. 100), contributed some further information, chiefly in regard to the latter point; and, replying to his remarks, Mr. Southwell (*tom. cit.* p. 172) dissented from his view that Otters, like other animals, breed most commonly in the spring, maintaining that the period of reproduction is in the winter—namely, from December to February inclusive.

In the 'Proceedings of the Zoological Society' (Feb. 1882), Mr. Cocks gave an account of the breeding of a pair of Otters in his possession, and published some supplementary notes in 'The Zoologist' for 1882 (pp. 201-204), chiefly in relation to the growth and daily behaviour of the young, of which two were produced, the period of gestation being estimated at sixty-one days. It proved afterwards to be sixty-three days.

From a subsequent article by Mr. Southwell (Zool. 1888, pp. 248-251), and communications from other contributors, we are led to the following conclusions:—that the Otter breeds in late autumn and winter, but more often in winter. Mr. Hurley, a competent judge, says the young are born towards the end of February—that the period of gestation is like that of the dog, precisely nine weeks; that, although the number of teats in the female is six, the number of young produced at a birth is generally two or three, very rarely four; and that they are born blind, and are suckled for six weeks, not touching fish until they are seven weeks old. The fact that quite young Otters have been found in every month of the year is explained by their being the progeny of female Otters that have paired as they arrived at maturity. For fuller details on all these points the reader may be referred to the articles above quoted.

SEA-BIRD COLONIES IN THE ISLE OF MAN.

By P. RALFE.

For a number of years, but especially during the last three summers, I have had opportunities of visiting the breeding-places of sea-birds in the Isle of Man, and have during that period seen nearly the entire coast. The extreme north has a shore of sand and gravel, either flat or with cliffs of sand and clay. In the neighbourhood of Castletown the sea-edge is of low limestone, but with these exceptions our coast is of steep and often lofty rock, broken by many curving bays and creeks. The principal nesting-places are on the west and south-west (that is, between Peel and Port St. Mary, going south), but the east has also at least two points where sea-birds are present in some numbers.

As regards particular species, the result of the observations I have been able to make is as follows:—

The Herring Gull, *Larus argentatus*, is here vastly the most abundant of all species. At many points, and sometimes for very considerable distances in almost unbroken continuity, its nests are to be found. Its long protection by law has no doubt contributed to this. It swarms also all the year round in our bays and harbours, feeding upon fish-offal on the quays, and general refuse in the harbours, and perching on the adjoining houses and even the steamers lying alongside. In flocks of hundreds it follows the plough, or settles in the fallow fields all over the country. It would be an interesting question how far its winter numbers are increased in spring by the arrival of gulls which have spent the winter in places which offer them no nesting facilities.

As in winter a flock of the Herring Gull is often attended by one or two Lesser Black-backed Gulls, *L. fuscus*, so a breeding-station often contains a pair or two of the same species. But at two spots the Black-backs have formed small colonies of their own in the midst of the grey birds. Both of these are upon isolated stacks, and they are not far distant from each other. These colonies, like the Kittiwakes to be presently mentioned, were first shown to me by my friend Mr. F. S. Graves in 1891.

I have seen and heard of only one colony of the Kittiwake, *Rissa tridactyla*, of small extent, and inhabited perhaps by a few hundred birds, as described in 'The Zoologist' for May last. It seems to be at no time common on our coast.

The Shag, *Phalacrocorax graculus*, breeds at many points, often in scattered pairs, here and there in considerable numbers. At some of these places I have also seen a few Cormorants, *P. carbo*, in early summer, but never noticed a nest of the latter; and common as the Cormorant is with us in winter (in Douglas Bay at least it certainly outnumbers the Shag at that season), I have never anywhere met with many at breeding time. Sir Wm. Jardine, who visited the island about sixty years ago, remarks ('Birds of Great Britain and Ireland,' iv. 238) on the Cormorant's breeding on broad rock-ledges in the Isle of Man. He also describes a Shag colony on the lofty cliffs of the island's southern extremity, which he says was "the most extensive that ever came under his observation," and remarks that there were "hundreds of nests." Though still common there, I doubt if the Shag's numbers are anything like so great at the present time.

Of the *Alcidæ*, the Razorbill, *Alca torda*, is the most generally distributed, and I think increasing in numbers, and possibly even establishing new colonies. It does not, so far as I am aware, breed on the east side. The Guillemot, *Lomvia troile*, is confined to the south-west, but pretty abundant there. The Puffin, *Fratercula arctica*, is more local than either, appearing only at the southern extremity of the main island, and on the Calf, where it is numerous.

The Black Guillemot, *Uria grylle*, is present, not in great numbers, at a few points. At one station, which is frequented every year, on May 21st, 1893, I observed a dozen or more of these birds. A boat had been pushed into a creek immediately beneath their haunt, some crevices under the beetling top of a low precipice, and the whole sat crowded together, only a few yards distant from the intruders, with outspread wings, uttering a clear piping cry. Another small party resorts yearly to a similar place about a mile distant. In another locality, not far from this town, I had at various times in previous years noticed a few when passing by steamer, and, as it seemed a very suitable spot for their nesting, I went there twice last summer, but failed to see any trace of them. At a fourth locality I saw a few in 1890, but on subsequent visits have not been able to observe any. Probably they are decreasing in number. The Black Guillemot, as has often been observed, swims very close under the rocks, and often takes refuge there when alarmed.

One sees it only in the immediate neighbourhood of its holes at nesting-time, and it is very confident and easily observed.

Beginning at the north of the island, and going down the west coast, the sandy brows are exchanged for rock about two miles south of Kirk Michael. A few Herring Gulls and a pair or two of the Lesser Black-backed Gull, *Larus fuscus*, nest at some spots north of Peel. But the first colony of any extent is south of that town, and is easy—indeed too easy—of access. It extends in an interrupted fashion for about two miles, but its main strength is on a range of cliffs, called in Manx, no doubt from the orange lichen which plentifully crusts its upper face, Bing Buigh. A path leads from Peel Harbour across a waste heathery hill to a slate-quarry, now deserted; about a quarter of a mile before reaching this the track, skirts the highest of the precipices, and looks down upon the stony strand which just at that point lies at their feet. The cliff, perhaps 200 feet high, here runs inland from the sea, and above the strand is almost perpendicular, while diagonally across its face passes something like a rude rock stairway, ironically known in local speech as "The Ladder." On the other side of the strand steep grassy brows, mixed with rock surfaces, descend almost to sea-level, and allow of a rather risky scramble to the bottom. At the point of the long precipice is a double cave, its two parts merging into one internally, but at the entrance separated by a great offshoot from the cliff above, which is prolonged into a singular mass of rock some fifty feet high, the flat summit of which cannot be reached from below. This outlier is a great Shag-roost, and fifty Shags or so dive into the clear water below when a boat approaches, while far up on the main rock-face others sit securely on their nests, from which they are, when incubation has once advanced, scarcely to be scared. A small colony of Razorbills mingles with the Shags, and a row of them sit with their dusky neighbours on the top of the outlier, the lower parts of which are profusely strewn with fragments of the weed used by the former in the construction of their nests (I saw it last summer strewn also with the fragments of Shags' and Razorbills' eggs broken there by some rapacious plunderer). In May the huge boulders and fallen earth of the beach were gay with the large dog-daisies of the Sea-feverfew, and up near the very top of the high cliff, on luxuriant grassy ledges, many Herring Gulls were nesting in

undisturbed security. But it is rather in the less precipitous and more varied surfaces on the other side of the strand that the gulls delight. Part of these slopes are covered with a rank abundance of the common nettle, and about here the nests are thickly scattered, usually in situations a little sheltered by some beetling brow. A little further south is another isolated rock, the "Cashtal Vooar," now commonly called, from its pointed horn, "The Church," and on its sea-side is another Shag-roost, while on its verdant top, and on the long steep brow of the mainland slope opposite, are more gulls' nests. Where the brow ends abruptly in a low steep cliff Shags' nests are pushed back into its shallow crevices between the overhanging ledges. In spite of the law, the Herring Gulls' nests are persistently robbed wherever they can be reached, but they nevertheless frequent the same spots year after year, as, for instance, on the brow just named, where there is no difficulty in walking down to and among them. The nests vary as much as do the eggs, from a few stalks of *Cochlearia* to a massive and almost neat structure of fine dry grass and leaves of the Thrift. I have never seen a single Black-backed Gull at this station.

Half-a-mile further south, also, at Traie Cabbage, so called from the Sea-kale, whose masses of blue foliage and white bloom enliven the strand, many Herring Gulls breed, and I have noticed that among the boulders of the beach there is one place that for twelve years or so has never failed to have a few nests. South of this shore are some lovely cliff-edges, where, in early summer, the sward is rich with rose-coloured Thrift, lilac-blue Squill, white Feverfew, and Campion, forming a very garden of blossom. Here and there, where some clear inlet leads to its cavern decked with glossy Sea-spleenwort, a Shag or two breeds. At the Gob-ny-Chassan, the extreme southern limit of the birds here, is a small but pretty colony of Razorbills, as well as a few at another point nearer Peel. When the tide is far out, the former station may be walked past. I think it has been established only within the last fifteen years.

Close to the Gob-ny-Chassan is the Ooig Vooar Cave, one of the finest on the island. Both here and at Traie Cabbage Jackdaws are abundant. For some little distance south of Glenmay, round the low point of the Niarbyl, no colonies are to be seen, but others are to be observed after passing the strand into

which the "Lhag" opens. Of the beauty of the white beaches the dark inlets, the green blossoming brows of this most charming and little-known portion of our coast, this is not the place to speak. Good numbers of Herring Gulls breed at Gob-yn-Ushtey; there are several steeply sloping brows occupied, some nests being placed deep among thick grass tufts, a thing of not common occurrence. Underneath is a "Shag rock," and some Shags nest in the abrupt and caverned cliffs in which the slopes end. The further side of the Gob (or point) is an enormous precipice, and the view southward from its top has a character of stern and desolate wildness very uncommon in our scenery. Beneath is the cliff just mentioned, sheer and bare of vegetation, and from your feet broken screes of stone and bracken, swarming with rabbits, fall to the water's edge further in front. Right ahead there heaves up a great mass of highland, part of the back-bone of the isle, presenting to the sea for miles a steep brow from 800 to 1400 feet in height, capped by the wind-swept watch station of Cronk-ny-Ircy-Lhaa, the whole reach without cultivated ground or inhabited house. As a rule, however, the actual cliff of this imposing coast is not of very great height, though the mountain is broken by clefts which make the task of keeping as close as possible to the sea a very toilsome one. In a long and barren gully which falls from the hill-top to the water lies the ruin of a little immemorial church, and beneath is a beautiful shore, where the rough white beaches of the Geinnagh Vane alternate with dark points, from whose dripping ledges springs luxuriant *Osmunda regalis*, and in whose high deep cavern the rocky walls are hidden by the gigantic growth of drooping Harts-tongue and *Asplenium marinum*. All along the Herring Gulls' nests are strewn, on the grassy ledges, the rough boulders, the rushes of earth, and the rough sheets of bare rock. Only one spot, the Stroin Vuigh, rivals the Gob-yn-Ushtey on this reach of coast. Here and there Herring Gulls breed all along to Fleshwick, the spots haunted by them conspicuous by their brighter green. Scattered pairs of Shags also breed at the more abrupt portions. At Stroin Vuigh a high cavern opens below the bird-haunted crags, and here, as well as in less numbers at one or two other places in the neighbourhood, the Razorbill, *Alca torda*, breeds. I saw last summer a few Lesser Black-backed Gulls among the crowds of Herring Gulls here.

On the other side of Fleshwick, Bradda presents somewhat

similar scenery, and much the same birds. On its northern parts many Herring Gulls breed, some on a series of craggy steeps hardly accessible, others near the inlet called Ghaw Dhoo, on brows where one can easily walk amongst them. Shags nest, but not in any numbers, in two or three places not approachable by land. Well on the Fleshwick side of Bradda is a cavernous opening occupying the inmost part of a recess between the two points. In this, and apparently confined to a very small space, is a colony of perhaps 150 Razorbills and Guillemots mixed. When I scrambled down to the low point called "Amulty," from which I could see the place, at a short distance, but across deep cavernous inlets, the birds streamed around in ceaseless circles in exactly the same beat, till the eye was weary of watching the constantly recurring procession.

On the high southern cliffs of the island and on the Calf, sea-bird life is more abundant and varied than elsewhere, the perpendicular-ledged faces about the Bay Stacka and the Sound, and the isolation of the Calf islet, offering the greatest facilities and protection to the true rock-breeders. I have already somewhat imperfectly described these colonies, and will not at present dwell further on them; they merit more minute investigation than I have ever been able to bestow upon them.

On the east the colonies are, as I have stated, more scattered. The most southern of these is a short distance from that well-known trippers' haunt, Port Soderick, but of the thousands whom the railway brings there very few row round the point of the Lhiack, or mount the abrupt rounded hill which marks the breeding-places, at least before such birds as local plunderers have spared have taken their departure. The colony is only of small extent, and shelters only Herring Gulls, with the usual odd Black-backs, a number of Shags which seem to leave in spring only their immature birds, and a non-breeding Cormorant or two.

From the summit of the high ground an apology for a track leads down, past great plants of Foxglove, so characteristic of Man, which in May have not yet displayed their rich spikes, over stony *débris* beneath overhanging juts of crag, to a shadowy recess all white with luxuriant beds of *Cochlearia*, emitting a faintly sweet scent. The water which makes this plant flourish so trickles from the cliff above, through the rubbish and rock-splinters half-

covered with a giant growth of dock, clumps of Hemp-agrimony, and the strange yellow-green of the golden Saxifrage. On the way down you pass scattered Gulls' nests, but to the right as you look towards the sea, they are thicker in a snug hollow but little above high water, and still further in the same direction you can see craggy shelves not accessible from below, where, on the broad slate ledges, the nests are placed against the sheltering rock. Underneath, as usual, where the ledges merge into sheer cliffs, are the Shags; but, as above mentioned, all mature birds seem to absent themselves here during the breeding season. From the topmost pinnacle is heard the harsh croak of the Raven, and the pair will keep watch, agitated yet defiant, until you are a mile away. Suddenly a Peregrine, with his magnificent flight, dashes through the crowd of Gulls. Far out over the slumbering sea he hastens, then turning, makes direct for the rock again, his sharp cry well distinguished amid their hoarse clamours. Rock Pipits, in their breeding plumage, delicately pretty birds when seen close, fly from stone to stone, amid the tangle-clad recesses near the water, and the bushy weeds higher up. Down in a hidden corner, where the bulging cliff-top yields them such a site as they love, a few Martins flit like butterflies. Unfortunately, this place is too well known to Douglas lads, and I fear few Gulls here bring off their clutches safely.

A few Herring Gulls nest at Wallberry, and on the seaward face of the stony desolate Barony Hill between Dhoon and Cornah a few more; at the latter place, on rocks not far above high-water mark, bare of vegetation, except for patches of Sea-pink, and sprinkled with little pools of brackish water. Maughold Head, the most eastern point of the island, with its curious humped outline and picturesque pinnacled stacks, adds to its singular beauty of outlook and its grey memories, the wild charm of sea-bird life. Most of the Herring Gulls here occupy a place to which they have given the name of Traie Foillan. In the caverned faces on the Ramsey side some Shags also nest.

A few remarks on some species, which, though not properly sea-birds, yet are often sharers of their stations, will not be out of place.

One such is the Grey Crow, *Corvus cornix*. At intervals pairs are scattered on the coast, and they are obtrusive on the attention of the most casual visitor. Their nests are often very

conspicuous. Though usually placed far out of reach of the spray, and often under protection of the highest cliff-ridge topping some brow, I saw one last year in a kind of gully, only some fifteen feet above high-water mark.

The Raven, *Corvus corax*, holds his own well on Man. During 1893 I visited seven nesting-places, and there are perhaps as many more. On May 9th I came upon two sites within a mile-and-a-half of each other. The first was above an unfrequented "traie," and exceedingly conspicuous, built on the back of a projecting and overhanging shelf, with a similar shelf behind it. It was only about twenty feet from below, and perhaps seventy from the top of the cliff, for this was here comparatively low. At one side a grassy brow ran up to a level with it, and I could make out at least one well-fledged young bird. Higher up was an old nest. The parents were very excited, and one of them kept constantly plucking dry grass from the ledges, and showering it around. The second site was on an immense perpendicular cliff, near the top; another nest lay on the same ledge at a few yards' distance, and a third a little higher up, forming a triangle. At this place also the pair of birds was in attendance. On May 14th I saw the young from another nest, which I have known for fifteen years, flying and scrambling among the crags in the vicinity of their birth-place. Even in winter the Raven does not entirely forsake its nesting-place. Thus on December 26th last I saw a pair at the usual spot.

Jackdaws are, in places, very numerous, often where no other birds frequent, as, for instance, on the brows between White Strand and Glen Mooar. I was, in 1893, disappointed in my hope of seeing much of the Chough, *Pyrrhocorax graculus*, in its narrowing limits, but in 1894 I met with it in several localities. Inexorable natural law, accelerated by the destructiveness of man, is, here as elsewhere, working out the extinction of this most graceful of the *Corvidæ*. Yet I think its scarcity must be somewhat over-estimated by the informant of Mr. H. A. Macpherson, who in his recently published 'British Birds' (p. 40), speaks of it as limited here to a few pairs. In 1890, in one of its localities, it appeared by no means rare. In the winter of 1893—94 some were seen on the sandy northern shores, to which they seem regularly to wander at that season. During the summer of those two years I met with them at six other localities, four of

which are doubtless breeding-places. These breeding-haunts at the present time are mostly remote and not easily accessible, and I may be excused for not particularizing them.

Pairs of Kestrels are located round the coast at short intervals. The rarer Peregrine frequents annually some of our finest headlands. The Rock Pipit is ever present, and pairs of the Stonechat enliven the gorze covers of the brows. I have already mentioned the Martin, *Chelidon urbica*. This bird is nowhere, I think, very common in Man, but visitors to Port Soderick may have noticed their nests clinging to the rock about the well-known "Smugglers' Caves," and a few may be met with at various other places of similar formation on the Santon and other coasts. In both 1893 and the present year a few nested on the gable of the pavilion of Derby Castle, Douglas, which is close to the shore and to the cliffs.

NOTES AND QUERIES.

MAMMALIA.

Marten in Co. Wicklow.—My attention having been called to an article in 'The Zoologist' of March last, under the heading of "The Marten in Ireland," in which the Editor requests further information relative to the haunts and habits of this beautiful animal, I have much pleasure in stating my experience, although the circumstances I am about to relate occurred so long ago as the winter of 1824. At or about that period several Martens were taken alive at Ballyarthur, in the county of Wicklow, under the following circumstances:—In the midst of a large oak-wood, nearly half a mile from the nearest dwelling, there was an octagon-shaped summer-house, one half being boarded at the back, about seven feet high, and thickly thatched with heather, the inside being ceiled, a space being left between it and the roof. In this secure, warm, secluded place the Martens took up their abode. The first intimation we had of their presence was seeing a hole in the thatch, about half-way up. We frequently heard them moving about in the roof, after remaining perfectly quiet for some time. This determined me to try and take some of them alive. I consulted our Scotch steward, who after a time had a large wooden box-trap made, open at each end, which answered the purpose admirably. By this means several of them were taken, and put into a clean hen-coop in the back kitchen of our house, with plenty of clean hay to keep them warm; in this they remained for several weeks. We fed them with birds, rabbits, &c.; the food was always eaten at night—never

touched in the daytime. So wild and untameable were they that on going near the cage they would rush about and never rest till we went away. On one occasion the steward on visiting the summer-house one evening, and when standing under the eave of the thatch, and near to the branch of an oak tree which extended close to the roof,—and which was the only way by which they could get on the house,—caught one when jumping off the roof to the tree, and, although severely bitten and scratched, held him till he took him to the house and put him into the cage with the others, having half-a-mile to walk with him, no other person being present. By degrees they all made their escape by gnawing away the boards of the coop. The last Marten that was taken at Ballyarthur was in 1872, when one was caught in a rabbit-trap during the winter of that year. I have no doubt there are Martens still in that locality. All those taken had the yellow throat and breast, and appeared to be fully grown.—H. L. BAYLY (Portland House, Ryde, Isle of Wight).

Barbastelle in Huntingdonshire.—Another specimen of the Barbastelle, *Synotus barbastellus* (see p. 187), was sent to me, alive, by Lady Ethel Wickham, on Sept. 4th. I find that this animal was captured in a cottage at Elton, and given to Lady Ethel for me by Mr. John Crisp, of Warmington. The village of Elton is in Huntingdon, though I believe that the boundary between that county and Northamptonshire runs within a few hundred yards of the cottage in which this bat was taken. I have therefore a scruple about claiming it as a Northamptonshire specimen. The individual in question was a female, and had a great deal of grey hair on the back and under-surface of the body. The former of these two animals alluded to above was of an almost uniform black-brown.—LILFORD (Lilford Hall, Oundle).

BIRDS.

Osprey in Bedfordshire.—On May 18th I visited Southill Pool, the only regular nesting haunt of the Great-crested Grebe in Bedfordshire, a pair of which, I am pleased to say, at that date, had a nest containing four eggs, which were eventually hatched, and the young reared. This pool I found was haunted by an Osprey, which stayed several hours in my company, searching for food, occasionally plunging into the water, but unfortunately at no time successfully. Now and again it rested on the overhanging trees surrounding the pool, sometimes amongst the thick green foliage, and at other times on some dead branch, from which a good look-out was easy. Nevertheless, the bird did not seem at all wild whilst on the wing. Twice it came within gunshot whilst I was standing in the open, and each time made one's blood boil (as the saying has it) to think of the keeper in the immediate background, to whom all pleading was in vain, and the Wild Birds Protection Act no intimidation. It is to be hoped,

nevertheless, that it will escape destruction.—J. STEELE ELLIOTT (Dixons Green, Dudley).

Hybrid Mallard and Sheldrake.—You may be interested to hear that a man in this county has this summer reared some young hybrids between the Sheldrake and Mallard. I hope to send you some further notes thereon by and by.—H. A. MACPHERSON (11, Victoria Place, Carlisle).

Occurrence of the "Cape Pigeon" at Bournemouth.—I was informed that a strange Petrel, pied all over, had been shot near the Old Harry Rocks, at Bournemouth, while it was following a foreign steamer. This was at the beginning of the present month. I have since received a photograph of the bird from Mr. Thomas Cooper, the birdstuffer of Poole, who had it to mount, and the bird is what I surmised it to be at the first, a "Cape Pigeon," *Daption capensis*. Pelagic birds, from all parts of the world, are liable to find themselves brought by accident to our shores, and the "Cape Pigeon," a well-known bird, is abundant in both the Pacific and Atlantic Oceans, and cannot be considered very extraordinary as a chance visitor.—MURRAY A. MATHEW (The Vicarage, Buckland Dinham, Frome).

American Goldfinch on Achill Island, Co. Mayo.—On Sept. 6th, while in Keem Bay, in company with some visitors to this island, I observed a small bird feeding on a thistle by the sandy beach. Its yellow colour and black head and wings made me think it might be an American wanderer, and, having my 12-bore with me, I easily secured it with a charge of No. 8 shot. It was in company with Linnets, Stonechats, and Meadow Pipits, and seemed quite at home, flitting about, and uttering a soft mellow note. After I had shot it, I was satisfied that I had one like it in my collection, namely, one that I shot in America in 1873. I immediately sent it to Mr. A. G. More, of Dublin, who identified it as the American Goldfinch, *Astragalinus tristis*. The migration of North American birds to Achill Head deserves attention, and on some future occasion I hope to deal with the subject more fully, as I consider Achill Head and Crougham great landmarks for migratory birds, as also the Blackrock Lighthouse, which throws its revolving light seawards for miles. I am convinced that many of the North American migrants visit our bold headlands, from the fact that I have observed and secured many of them in Achill. I should be glad to learn from any American naturalist how far north on the American continent the bird in question has been observed. So far as I know, this is the first example which has been taken in the British Islands. J. R. SHERIDAN (Dugort, Achill Island).

[Through the kindness of Mr. A. G. More, we have had an opportunity of examining the bird above referred to, which he has correctly named, and from the much worn appearance of the wing and tail-feathers—the latter especially being much abraded—we are decidedly of opinion that it had been not long previously in captivity. It is not unlikely that it may have

escaped from some homeward-bound vessel from New York, and found its way to land on the west coast of Ireland.—ED.]

FISHES.

Bonito in the Solway Firth.—A male example of the Bonito, *Thynnus pelamis*, was found dead upon the sands near Sillioth on Sept. 15th. It was nearly buried in sand, but some Gulls had opened the belly and extracted part of the internal organs. The visits of the Bonito to the Solway Firth are rare. The only specimen that had been taken on the English side of the Firth previous to this was caught in September, 1856 ('Fauna of Lakeland,' p. 477). In the present instance the fish is estimated to have weighed about five pounds.—H. A. MACPHERSON (Carlisle).

NOTICES OF NEW BOOKS.

Birds of West Cheshire, Denbighshire and Flintshire. By W. H. DOBIE. Reprinted from the Proceedings of the Chester Society of Natural Science and Literature. 8vo, pp. 282—351. With folding Map. Chester. 1894.

THE last part issued of the Chester Society's 'Proceedings' is an exceptionally good one. It contains papers on geology, meteorology, botany, and zoology, most of them of local interest, and all of them instructive. That by Prof. T. M. Hughes, of Cambridge, on "Caves and Cave Deposits," explains very clearly their mode of formation, and the nature of the evidence upon which theories as to their age have been founded. Mr. Alfred O. Walker, to whose encouragement and support the Society is much indebted, writes on the climate of Chester, and of the north coast of Wales, as well as on the natural history of the district explored by the Society, extending to the sea-coast of Flintshire and Denbighshire, and including as much of Cheshire as lies west of a line drawn southward from Warrington. Mr. Newstead, the Curator of the Grosvenor Museum, Chester, contributes an excellent paper on the Heronries of Cheshire and North Wales, as well as a Preliminary List of the Mammals. In the latter we note his allusion to a record of Daubenton's Bat in the old copper workings at Alderley Edge, the reference to which he has forgotten. He will find it in 'The Zoologist' for 1893, p. 103, and in the volume for 1888 (p. 222), he will find another notice of the capture in Cheshire of the Whiskered Bat. Four

instances are noted of the occurrence of the Marten (*Martes sylvatica*, Nilsson) within the last few years in the Chester district. One at Eaton on the Duke of Westminster's estate on the 8th July, 1891; another a few days later on the rabbit warren near Hope; a third at Connah's Quay on the 14th April, 1892, and a fourth, a very large male, near Llanfairfechan about the 28th April, 1892. The measurements are given of three of these. According to Mr. Newstead the Dormouse has only been met with in two localities in the district, namely, at Thornton-le-Moors, and at Nant-y-glyn, Colwyn Bay. The Harvest Mouse is included with doubt in his list; while the Bank Vole (*Arvicola glareolus*) is stated on the authority of the Rev. C. Wolley Dod to be common near Malpas.

But the most important contribution to this part of the Chester Society's 'Proceedings' is that by Mr. W. H. Dobie on the "Birds of West Cheshire, Denbighshire and Flintshire," of which, as above noted, we have received a separate copy for review. It extends to seventy pages, and has a useful map.

As twenty years have elapsed since Brockholes' list of the Birds of Wirral appeared in the first number of these 'Proceedings,' it was time that some fresh effort were made to deal with the avifauna of Cheshire, and Mr. Dobie's contribution is therefore very acceptable. The district to which his observations relate includes a great variety of country both in regard to altitude, ranging from the coast up to 1850 feet above the sea, and to the character of both land and water. According to Mr. A. O. Walker,

It comprises one side of the estuaries of the Mersey and Conway, and both sides of the Dee, having large areas of sand and mud laid bare at low tide, and eminently adapted for the wading and swimming birds. In Cheshire there are ranges of hills of triassic sandstone, covered on their summits in parts with forest and heath, as is especially the case in Delamere Forest. The low grounds are for the most part pasture, and few fields are without old marl pits, now full of aquatic plants, and the haunts of Moorhens, Dabchicks, and other waterfowl. The two Welsh counties, though not possessing mountains equal to those of Carnarvonshire, yet form a land of hill and dale with large areas of elevated moorlands. Along the south-west side of the estuary of the Dee rises the carboniferous range of hills, which forms a continuous outwork to the older formations extending from the mouth of

the Vale of Clwyd to Llangollen. Behind these is the loftier silurian range, forming the eastern boundary of the Vale of Clwyd; and on the western side of this is a vast area of confused hills and valleys, also of silurian age, mostly moorland, and sparsely inhabited. These two ranges unite at the head of the Vale of Clwyd, and pass on southward to the furthest limits of Denbighshire, including in this area the beautiful Vales of Llangollen and the Ceiriog.

Nor is the climate much less varied than the physiography of the district. That of southern Cheshire is practically the climate of our midland counties generally; while that on the north coast of Flintshire and Denbighshire more nearly approaches that of Devonshire in its equable character; that of Chester and the low parts of Flint and Denbigh being intermediate.

Why is it (says Mr. Walker) that with all this variety of soil, altitude, and climate with sea-coast, estuarial mud flats, mountain, moorland, and cultivated land, the district of the Chester Society has not a richer *avifauna*?

The answer, we presume, must be that, compared with other counties, the number of observant ornithologists in Cheshire is limited, while, as Mr. Dobie has remarked, "the district happens not to lie in any of the great routes of migration." In this respect it cannot compare with the eastern counties which receive the great autumnal bird-wave from across the North Sea, and it even lies off the line of the west coast movement of land birds, which are said to make their journey between the Mull of Galloway and Anglesey by way of the Isle of Man.

The number of species recognised by Mr. Dobie on what he regards as fairly good evidence of their occurrence in a wild state is about two hundred and twenty, but of these a few seem to us to challenge objection.

In regard to the Nightingale, it is stated, on the authority of Mr. C. Wolley Dod, a good observer, that in 1889, in Lowercross Gorse in the parish of Tilston-by-Malpas, a Nightingale sang every night through May; and Mr. W. E. Sharp vouches for its having been recognised at Ledsham in 1893. Mr. Ruddy knows of no authentic instance of its occurrence in North Wales, and thinks the Garden Warbler has been mistaken for it.

The statement of a dealer (p. 291) that a pair of Bearded Tits were shot in September, 1893, "in a little ditch full of reeds between Hoylake and West Kirby," is so remarkable that we are inclined to think there must be some mistake about it.

The Marsh Harrier, being well-nigh extinct as a breeding species, it is of interest to note that a nest was found on the Berwyns in 1877, in which year one of these birds was shot on Moel Ferna; while the rarer Greenland Falcon was met with in April, 1876, when one was picked up dead, but in a perfectly fresh condition, on the Llanbedr Estate, Ruthin. It was thought to have been killed by coming in contact with telegraph-wires.

Mr. Newstead writes of the House Martin (p. 295):—"At Ince quite thirty pairs build their nests on rafters in the interior of a barn, and have done so for a number of years. The barn has a large opening without doors on the north side. Such a situation is quite the home of the Swallow, but I never heard of the Martin nesting in the interior of a building."

"The difference in habits of the two birds in this respect (says Mr. Dobie) may be connected with the fact that the Swallow, where there are no buildings, sometimes builds in caves, and presumably did so before the existence of masonry. The Martin in like circumstances builds on the face of rocks; but, so far as I know, not in caves." On this subject we may refer Mr. Dobie to 'The Zoologist,' 1882, p. 437; 1883, p. 34; 1884, p. 470 (between Conway and Bangor); and 1894, p. 124. There is also a record of Martins' nests on the basaltic N.W. front of Pen-maen-Maur ('Field Nat. Mag.,' 1833, p. 546).

In the Warrington Museum there is a specimen of the Spotted Sandpiper (*Totanus macularius*), which was shot, with one or two others, on the bank of the Mersey near Fiddler's Ferry, in May, 1863. It was formerly in the collection of Mr. Gregson; and Mr. Gurney considers it one of the six most deserving of credence out of twenty-six recorded occurrences in Britain. (See his 'Rambles of a Naturalist,' p. 262).

Mr. Ruddy's account of the foundation of a colony of Black-headed Gulls on a small moorland lake near Llanderfel, nine miles from Corwen (p. 343), deserves mention. Two pairs nested there for the first time in 1888. Ten pairs nested there the following year, and they were more than doubled in 1890; while in 1893 there was quite a large colony.

These are some of the more interesting items of information in Mr. Dobie's Catalogue, and it is to be hoped that its publication will give encouragement to others to extend the observations which he has so usefully collected.

